

DATE 12/9/80

ADVISORY CIRCULAR



DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

Subject: FAA SPECIFICATION L-853, RUNWAY AND TAXIWAY RETROREFLECTIVE MARKERS

1. PURPOSE. This advisory circular contains the specification for L-853 Runway and Taxiway Retroreflective Markers.
2. EFFECTIVE DATE. Effective June 9, 1981, only that equipment qualified in accordance with the specification herein will be listed in AC 150/5345-1, Approved Airport Lighting Equipment.
3. CANCELLATION. Advisory Circular 150/5345-39A, FAA Specification L-853, Runway and Taxiway Retroreflective Markers, dated September 17, 1971, is canceled.
4. PRINCIPAL CHANGES. The specification has been revised to make a performance-oriented standard for semiflush and elevated retroreflective markers. Additionally, the requirements have been upgraded to reflect advances in reflector technology.
5. METRIC UNITS. To promote an orderly transition to metric units, this specification includes both English and metric dimensions. The metric conversions may not be exact equivalents, and until an official changeover to metric units is effected the English dimensions will govern.

A handwritten signature in black ink, reading "Robert J. Aaronson", is positioned above the printed name and title.

ROBERT J. AARONSON
Acting Associate Administrator for Airports

CHANGE 1

DATE 1/4/82

ADVISORY CIRCULAR

CHANGE



DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

Subject: Change 1 to SPECIFICATION L-853 RUNWAY AND TAXIWAY
RETROREFLECTIVE MARKERS--Revises Equipment Qualification
Procedures

1. PURPOSE. This Change revises the procedures for obtaining equipment qualification approval as contained in paragraph 4.
2. EXPLANATION. Procedures for obtaining equipment qualification approval are now contained in AC 150/5345-1G, Approved Airport Lighting Equipment, and supersede those contained in paragraph 4 of this advisory circular.
3. FILING THIS CHANGE. This Change should be filed on the front of the advisory circular. Page changes to reflect this revision will be made at a later date.

Leonard E. Mudd

LEONARD E. MUDD

Director, Office of Airport Standards

FAA SPECIFICATION L-853, RUNWAY AND TAXIWAY
RETROREFLECTIVE MARKERS

1. SCOPE AND CLASSIFICATION.

1.1 Scope. This specification covers the requirements for retroreflective markers for airport runways and taxiways.

1.2 Classification. Two types and two styles of retroreflective markers are covered by this specification.

1.2.1 Types. The type designation describes the function of the retroreflective marker.

- a. Type I, Semiflush Marker for Centerline Marking.
- b. Type II, Elevated Marker for Edge Marking.

1.2.2 Styles. The style designation applies to type I markers only.

- a. Style I, Snowplowable Marker.
- b. Style II, Non-Snowplowable Marker.

2. APPLICABLE DOCUMENTS.

2.1 General. The following publications of the issue in effect on the date of application for qualification form a part of this specification to the extent specified herein.

2.2 Federal Aviation Administration (FAA) Standard.

FAA-STD-013 Quality Control Program Requirements

2.3 Federal Specifications.

L-S-300 Sheetting and Tape, Reflective: Nonexposed Lens

L-P-380 Plastic Molding Material Methacrylate

2.4 Military Standard.

MIL-STD-810 Environmental Test Methods

(Copies of FAA standards may be obtained from the Federal Aviation Administration, Airway Facilities Service, Washington, D.C. 20591.)

(Copies of Federal specifications may be obtained from General Services Administration offices in Washington, D.C., Atlanta, Boston, Denver, Chicago, Kansas City, New York, San Francisco, and Seattle.)

(Copies of military standards may be obtained from the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120, Attention: Code 1052.)

3. REQUIREMENTS.

3.1 Retroreflective Material Requirements.

3.1.1 General.

3.1.1.1 Construction. Retroreflective material is designed to reflect light approaching at an oblique angle back toward its source. The required reflectivities of the retroreflective materials are specified below. Two types of retroreflective material are in wide use:

a. Sealed plastic lenses with a smooth face and a prismatic configuration on the back (referred to herein as lens retroreflectors).

b. Flexible sheeting with a smooth face, embedded optical retroreflective elements, and an adhesive backing (referred to herein as sheet retroreflectors).

3.1.1.2 Alternate Reflectors. Alternate retroreflective materials may be proposed for use on L-853 markers. The manufacturer must demonstrate to the FAA's satisfaction that the overall marker performance is equivalent to markers with lens or sheet material. Thus, a material with superior reflectivity may be designed with a smaller retroreflective surface, while a material with inferior reflectivity would require a marker with a larger retroreflective surface. Any alternate material must meet all environmental requirements.

3.1.1.3 Configuration. The configuration of the retroreflective material on the type II marker is optional, but should be designed to maximize visibility. For example, sheeting may be laid out in bands across the face of the marker, or a number of lenses may be arranged in a geometric pattern on the marker. The proposed layout must present at least the specified viewing area in all viewing directions.

3.1.2 Retroreflective Sheeting Requirements. The retroreflective sheeting shall be manufactured and shall perform in accordance with the requirements of Federal Specification L-S-300, Sheeting and Tape, Reflective: Nonexposed Lens. The material shall be reflectivity 2 or reflectivity 4. The sheeting manufacturer may certify compliance with this specification.

3.1.3 Lens Retroreflector Requirements.

3.1.3.1 Reflectivity. Lens retroreflectors used in elevated markers shall have reflectivity as specified in table 1. Lens retroreflectors used in semiflush markers shall have retroreflectivity as specified in table 2. The values listed are for a white (clear) retroreflector. Yellow retroreflectors shall be at least 60 percent of this value; red and green retroreflectors shall be at least 25 percent of this value; and blue shall be at least 8 percent of this value.

3.1.3.2 Chromaticity. The colors approved for use on retroreflective markers are white (clear), yellow, red, green, and blue. The manufacturer shall submit a sample of each proposed lens color for the FAA's approval. The markers may be unidirectional, bi-directional with the same color, or bi-directional with different colors. The particular color required depends on the intended use.

Table 1. Minimum specific intensity per unit area for clear (white) lens retroreflectors (candelas per footcandle per square inch).

Observation angle (degrees)	Entrance angle (degrees)	Specified brightness
0.1	0	14.0
0.1	20	5.6
0.167	0	10.0
0.167	20	4.0
0.33	0	7.0
0.33	20	2.8

Table 2. Minimum specific intensity for clear (white) semiflush markers (candelas per footcandle).

Observation angle (degrees)	Entrance angle (degrees)	Specific intensity
0.2	0	3.0
0.2	20 Right	1.2
0.2	20 Left	1.2

3.1.3.3 Fabrication. The reflectors shall consist of a transparent plastic face (the lens) and an opaque back fused to the lens (under heat and pressure) around the entire perimeter to form a homogeneous unit permanently sealed against dust, water, and water vapor. The reflector shall be one of the colors specified in 3.1.3.2. The lens shall consist of a smooth front surface free from projections or indentations other than for identification and a rear surface bearing a prismatic configuration so that it will effect total internal reflection of light. The manufacturer's trademark shall be molded legibly into the face of the lens. The shell material shall conform to Federal Specification L-P-380, Plastic Molding Material Methacrylate, Type I, Class 3.

3.2 Environmental Requirements. Retroreflective markers shall withstand the following environmental conditions:

- a. Temperature. Any temperature between 65°C and -55°C.
- b. Corrosion. Exposure to a salt fog.
- c. Humidity. Any relative humidity between 10 and 95 percent.

3.3 Type I Semiflush Marker.

3.3.1 Design. The centerline markers shall be designed to provide a large retroreflective surface while providing a small obstruction to passing aircraft. Snowplowable markers shall withstand the impact of a snowplow blade without damage or shall be configured so that the blade passes over the marker. The base shall have adequate area to dissipate the loading specified in 4.2.7 and to provide for secure bonding to the pavement. The marker may be unidirectional or bi-directional, depending on the user's requirements. The design of the marker shall minimize scratching and abrasion of the retroreflective material.

3.3.2 Dimensions. The semiflush marker shall not project more than 3/4 inch (20 mm) above the pavement surface. All corners and edges projecting above the pavement shall be rounded to a minimum radius of 1/8 inch (3 mm). The minimum retroreflective area in each viewing direction shall be 1.5 square inches (1000 mm²) for style I markers and 3 square inches (2000 mm²) for style II markers.

3.3.3 Bonding. All markers bonded to the pavement surface shall have a clean, flat, hard, rough-textured surface that will promote bonding. The bonding material shall be specified or supplied by the manufacturer and shall meet the requirements of 4.2.5.

3.4 Type II Elevated Marker.

3.4.1 Design. Three configurations of elevated markers are described herein: (a) a plane (flat) surface with retroreflective lenses attached; (b) a plane surface with retroreflective sheeting attached; or (c) a cylindrical surface with retroreflective sheeting attached. The marker shall be as compact as practical while presenting the required retroreflective area. Alternative marker configurations may be utilized if the manufacturer demonstrates comparable retroreflective performance. The retroreflective material must be at least 2 inches (50 mm) above the ground when mounted.

3.4.2 Dimensions.

3.4.2.1 Plane Markers. For a plane surface with retroreflective lenses, the retroreflective surface must be at least 6.5 square inches (4000 mm²). For a plane surface marker with retroreflective sheeting, the retroreflective area must be at least 24 square inches (15 000 mm²). If the plane markers are bi-directional, these figures represent the required area facing each direction.

3.4.2.2 Cylindrical Markers. For a cylindrical surface marker, at least 96 square inches (60 000 mm²) of retroreflective sheeting shall be wrapped uniformly about the cylinder. The minimum cylinder diameter is 2 inches (50 mm) and the maximum cylinder diameter is 8 inches (200 mm). The height of the marker shall be not less than 14 inches (350 mm) and not greater than 30 inches (750 mm). The marker height should be kept as low as practical, since it presents less of an obstruction to aircraft and a lower profile to the wind.

3.4.3 Construction.

3.4.3.1 Mounting System. The elevated marker is intended to delineate active aircraft areas; therefore, it may be mounted on paved or unpaved surfaces. The manufacturer shall provide a satisfactory mounting system for the appropriate type of surface. The mounting system shall withstand the required wind loading and shall be designed to prevent the marker or its components from being ingested by jet aircraft.

3.4.3.2 Frangibility. The marker shall be designed so that it will not damage an aircraft if it strikes the marker. To achieve this goal, the marker shall either be flexible or be mounted with a frangible fitting. To utilize a nonfrangible mounting, the marker must readily bend or flex when struck. Each marker and mounting system shall withstand a wind speed of 100 mi/h (85 knots) without permanent deformation and shall retain its original shape and position in winds up to 50 mi/h (45 knots).

3.4.3.3 Materials. Any metal used in the elevated marker or associated mounting hardware shall either be noncorrodible or be plated to resist corrosion. The plane-type markers and mounting hardware shall be constructed so that the plane orientation will not change when the marker is subjected to the specified wind conditions. The reflective sheeting for all styles of markers shall be securely fastened to the marker body so that it will not slip or loosen when exposed to the specified environmental conditions.

4. QUALITY ASSURANCE PROVISIONS.

4.1 Qualification Requirements.

4.1.1 Qualification Request. Requests for qualification approval must be submitted in writing to the Office of Airport Standards, Attention: AAS-200, Federal Aviation Administration, Washington, D.C. 20591. Requests must include:

- a. A list of the types and styles of markers, along with the manufacturer's catalog numbers, for which qualification approval is requested.
- b. A copy of proposed test procedures and test data sheets and a statement as to whether the manufacturer proposes to conduct the tests or name and location of the independent testing laboratory where the tests are to be conducted (4.1.2).
- c. A copy of the manufacturer's proposed guarantee for the equipment (4.1.4).
- d. A copy of the manufacturer's quality control plan (4.1.3).
- e. A preliminary copy of the equipment installation instructions (4.1.5).

4.1.2 Qualification Testing. The equipment must pass all tests in 4.2. The manufacturer shall supply all test equipment and bear all testing costs. Tests may be conducted at the manufacturer's plant or at an independent test laboratory acceptable to the FAA. The FAA reserves the right to witness any or all tests.

Where the FAA waives the option to witness tests, the manufacturer must submit a certified copy of all test reports. The manufacturer must give 2 weeks' notice of the testing date.

4.1.3 Quality Control Provisions. The manufacturer shall provide and maintain a quality control program in accordance with FAA-STD-013, Quality Control Program Requirements, except that facilities for an FAA Quality Assurance Representative are not required.

4.1.4 Guarantee. The manufacturer shall provide the following minimum guarantee for each equipment: That the equipment has been manufactured and will perform in accordance with this specification and that any defect in material or workmanship which may occur during proper and normal use during a period of 1 year from date of installation or a maximum of 2 years from date of shipment will be corrected by repair or replacement by the manufacturer f.o.b. factory.

4.1.5 Installation Instructions. The manufacturer shall include complete installation instructions with each shipment. These instructions shall give guidance on the orientation of the markers, the site preparation, the specifications for adhesive (for semiflush marker), the leveling criteria, and any other information necessary to insure that the installed markers meet the specified performance levels.

4.1.6 Qualification Approval. Manufacturers who have met all requirements specified herein will be listed as approved suppliers in AC 150/5345-1, Approved Airport Lighting Equipment. Once equipment is on the approved list, any changes to the equipment that are not approved by the FAA will cause removal of the equipment from the list. Requests for design or component changes must be submitted to the office in 4.1.1 and must be accompanied by supporting documentation for the change. Substitution of components which are identical in rating and size and equal or better in quality does not require prior FAA approval.

4.2 Qualification Tests. The following tests shall be run on sample markers. A sample of each proposed color shall be submitted for the FAA's approval.

4.2.1 Retroreflective Elements. This section specifies tests for the retroreflective component of the marker. The performance standards and tests are excerpted from Federal Specification L-S-300. The manufacturer may either test the retroreflective material or provide certification from the supplier that these standards are met.

4.2.1.1 Retroreflective Sheeting. The retroreflective sheeting shall pass the tests listed for reflectivity 2 or reflectivity 4 sheeting material in Federal Specification L-S-300.

4.2.1.2 Retroreflective Lenses. Retroreflective lenses shall meet the requirements for reflectivity and chromaticity in 3.1.3. The tests shall be conducted according to the procedure in Federal Specification L-S-300, except that the angular aperture of the source shall be 0.1 degree and the angular aperture of the receptor shall be 0.025 degree.

4.2.2 High Temperature Test. Nonmetallic markers shall be subjected to a temperature of 65°C (+2°) for a period of not less than 7 hours. Any evidence of heat damage, such as deformation, blistering, cracking or crazing of plastic material, or deterioration of filler material, shall be cause for rejection.

4.2.3 Low Temperature Test. Nonmetallic markers shall be subjected to a temperature of -55°C (+2°) for a period of 24 hours. Evidence of damage or porosity shall be cause for rejection.

4.2.4 Corrosion Test. The sample marker shall be subjected to a salt fog test as detailed in MIL-STD-810, Environmental Test Methods, Method 509.1. Any evidence of damage, rust, or corrosion shall be cause for rejection. Markers with no ferrous metal components are exempted from this test.

4.2.5 Type I Semiflush Marker Bond Test. A 2 1/4-inch + 1/4 inch (57 mm + 6.4 mm) diameter steel fitting shall be bonded to the bottom surface of the type I marker with adhesive material specified for use with the marker. After the adhesive material cures, the steel fitting shall be pulled away from the marker at a rate not greater than 2,500 pounds (1150 kg) per minute. The adhesive material and bottom surface of the marker shall be considered unsatisfactory if there is complete separation with a pull of less than 1,500 pounds (700 kg).

4.2.6 Type I Semiflush Marker Seal Test. To demonstrate the integrity of the seal, the type I marker shall be subjected to the immersion test described in MIL-STD-810, Method 512, Procedure I. Any evidence of water or condensation in the marker shall be considered unsatisfactory performance.

4.2.7 Type I Semiflush Marker Load Test. This test shall be the last test made. The type I marker shall be bonded to a flat steel plate mounted in a standard testing machine. The load shall be applied to the top part of the marker through a block of rubber, 4 inches (10 cm) in diameter, 1 inch (2.5 cm) thick with Shore A hardness of 55 to 70. A total of 10,000 pounds (4500 kg) shall be applied uniformly over the area of the rubber at a rate of not greater than 2,500 pounds (1500 kg) per minute. The marker shall be considered unsatisfactory if there is any permanent deformation, cracking, or breaking of any materials used.

4.2.8 Type II Elevated Marker Wind Load Test. The elevated marker and its mounting system shall be subjected to wind load tests. Apply a wind load of 50 mi/h (43 knots) for a flexible marker to demonstrate that the marker remains upright at this wind speed. Apply a wind load of 100 mi/h (86 knots) to all markers; the markers and mounting system shall not show any signs of permanent distortion or failure from this wind load. Static loading may be used to demonstrate the wind loading requirements.

